

STD Bus Products

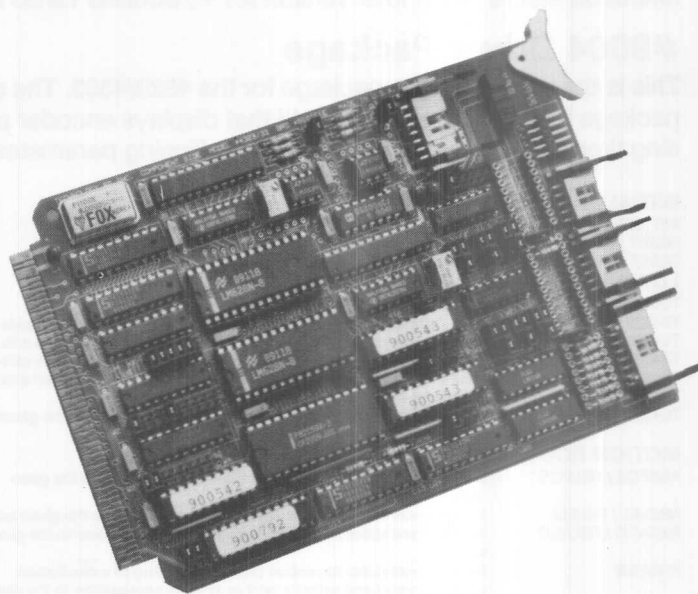
Motion Control

TECHNOLOGY  INC.

MODEL 4323 SERVO MOTOR CONTROLLER - STD MODEL 4333 SERVO MOTOR CONTROLLER - STD (1-2 AXES)

FEATURES

- 32-BIT DSP-BASED POSITION, VELOCITY, AND ACCELERATION REGISTERS
- OPTIONAL SOFTWARE DRIVERS FOR LINEAR/CIRCULAR INTERPOLATION ELECTRONIC GEARING, & TUNING
- SERVO UPDATE TIME OF 256 USEC AND REAL TIME INTERRUPTS
- INPUTS FOR ONE INCREMENTAL ENCODER & THREE OPTO-ISOLATED EXTERNAL INTERRUPT INPUTS PER AXIS
- 12-BIT ± 10 VOLT OUTPUT (4323 ONLY)
7-BIT PWM PLUS SIGN OUTPUT (4333 ONLY)



APPLICATIONS

Motion control systems configured within an STD or STD32™ Bus structure can use the Models 4323 and 4333 to control one or two DC servo motors without greatly increasing CPU overhead. Operations that require precision servo control and positioning may be accommodated.

DESCRIPTION

Complex positioning and velocity profiling may be performed with the Model 4323 and 4333 Servo Motor Controller cards. Each card intelligently controls one or two DC servo motors.

The cards use motion control ICs (DSP type) developed by National Semiconductor. These ICs offer position and velocity operating modes, with programmable velocity profiling. A set of 23 commands is used with the ICs. Commands may be executed on-the-fly.

In the position operating mode, the host processor specifies acceleration, maximum velocity and final position. The motor will accelerate until the maximum velocity is reached or until the motor must begin the decelerate to stop at its final position. In the velocity mode, the motor accelerates to the command velocity and maintains that velocity until a new command is given. Trajectory parameters are 32-bit values. Acceleration and velocity each have 16 integral bits and 16 fractional bits.

A digital Proportional-Integral-Derivative (PID) filter is used to compensate the control loop. The filter processes the position error, producing an output for the motor drive amplifier. Displacement from the desired position is opposed by an output that is proportional to the position error, the integral of the error, and the derivative of the error.

The Model 4323 features a 12-bit D/A Converter. This converter produces a ± 10 volt motor command. Model 4333 provides sign and magnitude 7-bit Pulse-Width Modulated (PWM) output signals for directly driving switch-mode drive amplifiers.

Each board provides inputs for feedback from two incremental encoders with quadrature output. Phase A, Phase B, and Index signals are accommodated. The Index line may be used to record the home position of the motor if it is not used by the encoder. Single-ended and differential encoders can be used.

Three opto-isolated external inputs per axis go through polarity selection logic to an 82C59 programmable interrupt controller. In addition, two of the inputs may be set up as limits that cause their respective analog outputs to be grounded.

4323/4333 SOFTWARE

Technology 80's software philosophy is to aid the programmer in the development of motion control applications while maintaining flexibility and high performance. Rather than defining a unique "high-level" motion language we provide a library of assembly routines (to reduce size and increase speed) that can be called from popular languages already used by the programmer. All the programmer has to do is to add an "include" statement to the source code and link with the proper library after compiling (or assembling).

Languages supported: Microsoft C version 4.0 +, Microsoft Quick C version 2.0 +, Microsoft Quick Basic version 4.0 +, Borland Turbo C version 2.0 +, Borland Turbo C++ version 1.0 +, Borland Turbo Pascal version 5.0 +, Microsoft Macro Assembler version 5.1 +, Borland Turbo Assembler version 2.0 +.

#9004 Driver Package

This is the base software package for the 4323/4333. The driver instruction set is listed below. Also included in this package is a Graphical Tuning Aid that displays encoder position as a function of time. Overshoot, undershoot and settling time are observable on the display. Tuning parameters may be adjusted via keyboard commands.

INITIALIZATION ROUTINES

INIT_SERVO Initializes the 4323 Software
RESET_AXIS Resets the given axis
RESET_ALL Resets all the axes and all the boards

LOW-LEVEL AXIS CONTROLLER ROUTINES

TE4323_WR_CMD Writes a command byte to the given axis
TE4323_WR_WORD Writes a command byte and a data word (16 bits) to the given axis
TE4323_WR_LONG Writes a command byte and a long word (32 bits) to the given axis
TE4323_RD_WORD Reads a command byte and reads a data word from the given axis
TE4323_RD_LONG Reads a command byte and reads a long word from the given axis
TE4323_RD_STAT Reads the status port on the given axis
TE4323_SERVO Writes a command byte and reads or writes data bytes to the given axis

MOTION ROUTINES

ABSPOS / RELPOS Sends a new absolute or relative destination position to the given axis
ABSVEL / RELVEL Sends a new absolute or relative command velocity to the given axis
ABSACC / RELACC Sends a new absolute or relative command acceleration to the given axis
PROFILE Sends a new absolute motion profile, consisting of a destination position, command velocity, and command acceleration to the given axis
START Start the motion defined by one of the above motion routines
STOP_MOVE Decelerates the given axis to a stop
ABORT_MOVE Stops the given axis as fast as possible
COAST Causes the motor to coast to a stop
VELMODE Runs the given axis in velocity mode at the specified velocity
HOME Defines the current position as zero

FILTER ROUTINES

FILTER Loads all the filter parameters to the given axis
FILTER_KP Loads the filter's proportional term
FILTER_KI Loads the filter's integral term
FILTER_KD Loads the filter's derivative term
FILTER_IL Loads the filter's integration limit
FILTER_SI Loads the filter's derivative sampling interval
READ_ISUM Reads the integration sum on the given axis

DATA REPORTING ROUTINES

ACTPOS Returns the axis' actual position
DESPOS Returns the axis' desired position
ACTVEL Returns the axis' actual velocity
DESVEL Returns the axis' desired velocity

INDEXPOS
COMPLETE

Returns the axis' index position
Returns "ACTIVE" if the axis' motion is complete, otherwise returns "INACTIVE"

BREAKPT

Returns "ACTIVE" if the axis' breakpoint has been reached, otherwise returns "INACTIVE"

INDEX

Returns "ACTIVE" if the index has occurred, otherwise returns "INACTIVE"

CMDERR

Returns "ACTIVE" if a command error has occurred, otherwise returns "INACTIVE"

WRAPAROUND

Returns "ACTIVE" if a wraparound has occurred, otherwise returns "INACTIVE"

POSERR

Returns "ACTIVE" if an excessive position error has occurred, otherwise returns "INACTIVE"

READ_SIGNALS

Reads the Signals Register from the given axis

SERVO INTERRUPT ROUTINES

SBPABS

Sets an absolute breakpoint

SPBREL

Sets a relative breakpoint

SINDEX

Tells the axis to look for the next index

SERRI

Sets the following-error limit, generating an interrupt if the limit is exceeded

SERRS

Sets the following-error limit, causing the motor to coast and generating an interrupt if the limit is exceeded

MASKINT

Masks an interrupt on the axis controller

UNMASKINT

Unmasks an interrupt on the axis controller

RSTINT

Resets and interrupt on the axis controller

READINTS

Returns the active interrupts from the axis controller

MOTOR CONTROL AND LIMIT ROUTINES

MOTOR_ON

Enables the axis' motor output

MOTOR_READ

Returns "ACTIVE" if the axis' motor output is enables, otherwise returns "INACTIVE"

LIMIT_READ

Returns the state of the axis' limit inputs

INTERRUPT ROUTINES

INT_INIT

Initializes the interrupt controller on the 4323

INT_DISABLE

Disables the given interrupt source on the 4323

INT_ENABLE

Enables the given interrupt source on the 4323

INT_POLL

Returns which, if any, interrupt on the 4323 is active

INT_EOI

Sends and "end of interrupt" command to the interrupt controller on the 4323

ENABLE_IRQ

Enables the interrupt request output on the 4323

DISABLE_IRQ

Disables the interrupt request output on the 4323

#9006 Motion Coordination Drivers

This set of software drivers consists of routines for linear/circular interpolation and electronic gearing/master-slave. Circular interpolation describes the coordination of two independent motor axes to produce an apparent circular motion. The move will be performed at a user specified velocity, with arc center-point and ending-point entries describing the arc itself. An increment entry allows the user to indicate the angle step to calculate with, since all the interpolation math is accomplished "on-the-fly". The electronic gearing (master-slave) operation describes the tracking of one axis of motion by another. The tracking (or slave axis) can be programmed to follow the motion of the master axis in either a velocity or position mode as required. The direction of rotation and tracking ratio (1:65536) are also user variables.

#9008 Servo System Simulation Software

This software package is an "off-line" motion system simulator used by the designer to help define system components and check performance before running any actual hardware. The user enters information such as motor data, mechanical data, encoder resolution, gain and desired motion profile. The display indicates the velocity of the trajectory generator (within the motion controller), velocity of the system, and following error. The emulation of the motion controller is based on the National Semiconductor LM628/629 ICs used on most Technology 80 servo controllers. System variables may be modified by the user to achieve optimum performance. The values obtained by the simulation may then be transferred to actual system components resulting in a high probability the system will perform as needed.

CONNECTOR PIN ASSIGNMENTS:

Front Plane Interrupts J2		Encoder Inputs J3 (Axis B), J4 (Axis A)	
Pin	Description	Pin	Description
1	Ground	1	Phase A
2	IRQ1	2	Power (+5 or 12)
3	Ground	3	Ground
4	IRQ2	4	Phase A (Diff) or GND
5	Ground	5	Phase B (Diff) or GND
6	IRQ3	6	Index (Diff) or GND
7	Ground	7	Power (+5 or +12)
8	IRQ4	8	Phase B
9	Ground	9	Power (+5 or +12)
10	IRQ5	10	Index

LIMIT INPUTS (J5)			
Pin	Description	Pin	Description
1	+5	9	+5
2	Ground	10	Ground
3	Axis B Home +	11	Axis A Home +
4	Axis B Home -	12	Axis A Home -
5	Axis B Limit 1 +	13	Axis A Limit 1 +
6	Axis B Limit 1-	14	Axis A Limit 1-
7	Axis B Limit 2 +	15	Axis A Limit 2 +
8	Axis B Limit 2-	16	Axis A Limit 2-

MOTOR DRIVE OUTPUTS (J1)			
Pin	Description	Pin	Description
1	Axis B (Not Used)	8	Axis A (Not Used)
2	Axis B PWM Sign	9	Axis A PWM Sign
3	Axis B PWM Pulse	10	Axis A PWM Pulse
4	Axis B Opto +5 Input	11	Axis A Opto +5 Input
5	Axis B Opto Ground	12	Axis A Opto Ground
6	Axis B Analog Output	13	Axis A Analog Output
7	Analog Ground	14	Analog Ground

MODEL 4323 SERVO MOTOR CONTROLLER - STD

MODEL 4333 SERVO MOTOR CONTROLLER - STD

SPECIFICATIONS

SYSTEM COMPATIBILITY

STD Bus, STD32™, 82C59 Interrupt Controller,
Cascaded interrupts are supported.

ENCODER COMPATIBILITY

Quadrature type incremental encoders with
a maximum encoder input rate of 1 MHz.
Open collector or totem pole drivers, single-
ended or differential inputs.

CARD DIMENSIONS

4.5" x 6.5" x 0.6"

OPERATING RANGE

0° to 70° C

VOLTAGE REQUIREMENTS

STD Bus: +5V @ .5A (typical)

1.1A (maximum)

+12V @ 30mA (typical)

70mA (maximum)

-12V @ 50mA (typical)

90mA (maximum)

MATING CONNECTORS

10-Pin Headers (J2, J3, J4)

Digi-Key CKC10T-ND

Digi-Key CKR10T-ND

16-Pin Header (J5)

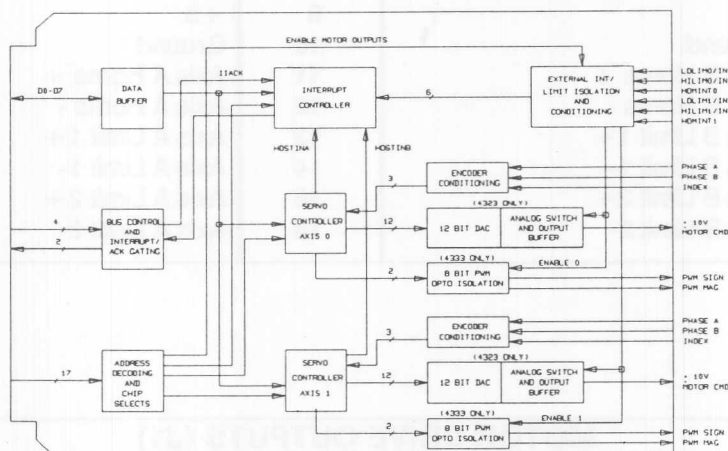
Digi-Key CKC16T-ND

Digi-Key CKR16T-ND

14-Pin Header (J1)

Digi-Key CKC14T-ND

Digi-Key CKR14T-ND



Model 4323/4333 Block Diagram

ORDERING INFORMATION:

Model 4323-1 Servo Motor Controller - Analog Output (1 Axis)

Model 4323-2 Servo Motor Controller - Analog Output (2 Axes)

Model 4333-1 Servo Motor Controller - PWM Output (1 Axis)

Model 4333-2 Servo Motor Controller - PWM Output (2 Axes)

Also See: 9004 Software Drivers

9006 Application Software Drivers

System Design Aids

6400 Series of Servo Motor Amplifiers

Warranty: Technology 80 Inc. provides a limited 2 year warranty on all of its STD Bus-based products, in accordance with its warranty policy.

Note: The information in this publication has been carefully checked and is believed to be reliable; however, no responsibility is assumed for possible inaccuracies or omissions.

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